

## RESEARCH

# Nurses' perception of their role in extracorporeal membrane oxygenation care: A qualitative assessment

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**Abstract**

**Background:** Recently, there has been interest in the education of nursing personnel to provide veno-venous extracorporeal membrane oxygenation in Kuwait. There is need to understand the experience of nurses who take on this new role.

**Aim:** We aimed to explore the perspectives of nurses about their role, with a special focus on their competencies and the challenges faced while caring for patients who require extracorporeal membrane oxygenation.

**Methods:** We used a qualitative descriptive approach, using in-depth individual interviews. Nineteen nurses working with veno-venous an extracorporeal membrane oxygenation machine in an adult intensive care unit of a general hospital in Kuwait were included in the study. Interviews were audio-recorded, transcribed verbatim, and analysed thematically.

**Results:** The role of nurses was found to be diverse and challenging and involved engaging in multiple responsibilities. Nurses worked with other health care providers in a team, which facilitated their performance. Nurses viewed themselves as competent to perform their role and attributed their competency mainly to the training received and the experience spent providing extracorporeal membrane oxygenation care. In executing their role, nurses reported encountering significant challenges, including heavy workload, inefficient communication among colleagues, and a lack of an organized/supportive system.

**Conclusions:** This study suggests that nurses play an integral role in the management of patients on extracorporeal membrane oxygenation. An understanding of their role and their competence, the challenges they face with in the care setting, and providing a supportive environment is essential for transformation in the practice of extracorporeal membrane oxygenation nursing.

**KEYWORDS**

challenges in ECMO care, competency of ECMO nurse, ECMO, ECMO nurse, qualitative study, roles of an ECMO nurse

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## 1 | BACKGROUND

Extracorporeal membrane oxygenation (ECMO) is a form of modified cardiopulmonary bypass circuit that serves as an artificial heart and lung, allowing the lungs to rest and recover from respiratory failure while minimizing further iatrogenic ventilator-induced lung injury associated with conventional systems.<sup>1</sup> ECMO has traditionally been used in end-stage lung disease and circulatory collapse and is being adopted for use in right-sided heart failure, as a bridge to heart and lung transplantation, and as rescue therapy for both sepsis and post-organ transplantation.<sup>2</sup> Use of ECMO has been significantly increasing over the last decade and is now considered a mainstream lifesaving treatment modality in critical care medicine.<sup>2,3</sup> With the recent Coronavirus Disease 2019 (COVID-19) outbreak, ECMO has been found to be very useful for the treatment of severe forms of COVID-19 and has been successfully implemented in various hospitals.<sup>4,5</sup>

Being a complex and high-risk intervention, ECMO requires a team of providers, including anaesthesiologists, ECMO specialists, ECMO nurses, pharmacists, nutritionists, social workers, perfusionists, surgeons, respiratory therapists, and others.<sup>6,7</sup> In Kuwait, the team includes an ECMO consultant, ECMO registrar, perfusionist, ECMO nurse, and cardiac/vascular surgeon. In addition, being a relatively new intervention, ECMO requires specific staff training in order to maintain high standards and safe care.<sup>8,9</sup> The ECMO team also requires continued refresher training to keep them updated on new developments about the intervention.

Nurses have been reported to play a critical role in ECMO care. A cross-sectional international survey among 177 worldwide ECMO centres to understand the professional roles and responsibilities of staff managing the circuit found that, in 59% of the centres, the ECMO specialist nurse was suggested to be primarily responsible for the bedside management of the ECMO circuit.<sup>10</sup> As frontline workers, nurses are expected to exhibit a high level of competence in the delivery of ECMO care. Competencies such as the ability of nurses to identify complications and mechanical problems such as bleeding have been emphasized and form key competence needs.<sup>11,12</sup> Despite its importance, however, it has been reported that some providers lack the required competency/experience. The experiences of 10 ICU staff (five doctors and five nurses) working in a specialist ECMO centre in the United Kingdom was explored in a qualitative study, which established that staff experience a sense of mastery when managing technical aspects of the work.<sup>13</sup> However, many nurses reported feeling anxious when encountering new and challenging clinical scenarios and being overwhelmed by the level of risk, responsibility, and high expectation placed upon them even when lacking experience.<sup>13</sup> These data reveal a need for adequate preparation of ECMO providers to execute their responsibilities with the required competence.

Providing ECMO has been associated with a number of challenges. In 2009, while caring for critically ill patients with H1N1 influenza, nurses reported six specific challenges, which included caring for the very sick patients with critical illness, prolonged stay and high mortality rate in the patient group, impact of infection control requirements and wearing gowns and masks during a 12-hour

### What is known about this topic

- ECMO nurses work in a sensitive environment and undertake multiple and complex roles.
- ECMO management requires multidisciplinary teamwork, and nurses form a major part of the team.

### What this paper adds

- ECMO care is demanding to the nurses and sometimes results in role strain.
- ECMO nurses require the support of other colleagues and management to be able to adequately execute their role.
- ECMO management requires ongoing training and support for nurses to stay cognizant of new developments.

shift, feeling overworked and tired, isolated in a room, the unknown aspects of the disease process and its treatment, and fear of being infected.<sup>14</sup> If not properly addressed, these challenges may affect the care provided to patients during ECMO administration.

Despite the great trend of training of the ICU nursing staff for the bedside management of ECMO patients, there is lack of research evidence to understand their roles and the challenges they face during ECMO care.

## 2 | METHODOLOGY

### 2.1 | Study aim

This study aimed to investigate the perceptions of nurses about their role in ECMO care. This evidence will help the authorities identify areas that need further development in order to take appropriate measures that will improve quality in ECMO management.

### 2.2 | Study design

A descriptive qualitative approach was adopted, using tape-recorded interviews. Semi-structured interviews were used to allow for flexible data collection that resulted in a rich detailed description of the nurses' perceptions of their role in ECMO care.

### 2.3 | Study setting

An adult ICU in a general hospital in Kuwait under the umbrella of the Ministry of Health (MoH) was selected as this hospital is the only one in Kuwait that initiated Veno-Venous ECMO (VV-ECMO) (which is the focus of the current study). This hospital provides education and training to prepare nurses and other health care providers for specialized ECMO care.

**TABLE 1** Demographic characteristics of participating ECMO nurses (n = 19)

Variable	Years	n	Percent (%)
Gender	Female	17	89.5
	Male	2	10.5
Country of origin	India	19	100
Qualification	MSN	1	5.3
	BSN	14	73.7
	ADN	4	21
Years of ICU experience	≤ 5 years	2	10.5
	6-10 years	14	73.7
	11-15 years	2	10.5
	16-20 years	1	5.3
Years of ECMO experience	1 year	3	15.8
	2 years	7	36.8
	3 years	9	47.4

Abbreviations: ADN, associate degree of nursing; BSN, bachelor of nursing sciences; MSN, master of nursing sciences.

## 2.4 | Participant selection

### 2.4.1 | Sampling and sample size

Purposive sampling was adopted for this study for the selection of the participants. The study sample included a total of 19 nurses from the adult ICU in a general hospital in Kuwait. All potential participants approached to take part in the study agreed. Table 1 provides the nurse participants' data.

## 2.5 | Recruitment of participants

Researchers explained the study to potential participants in a meeting and clarified what taking part would involve, including reassurance of confidentiality and pseudo-anonymity during publication of the research results, and answered any questions. Participant information sheets (PIS) and consent forms for interviews were distributed to the staff.

## 2.6 | Data collection and management

The researcher introduced herself before commencement of interviews to create rapport with the participants and informed them of the purpose of the study. Privacy was ensured, and non-participants were not allowed in the interview session. Semi-structured interviews were conducted with the use of a topic guide (Appendix A). Each participant was interviewed once.

All interviews were conducted in English and lasted between 30 and 60 minutes. Interviews were audio-recorded and transcribed verbatim on the same day by the first author, who is a PhD holder and works as a Lecturer of Nursing. She is also a chronic disease and

qualitative research expert. Transcripts were checked for accuracy by the co-authors, and any identifiable information was removed prior to analysis. Field notes were taken during and/or after the interview to capture any key insights arising from the interviews.

## 2.7 | Maintaining of rigour

To maintain rigour, all authors were involved in the coding process. The lead researcher's previous work and research experience as a nurse in a different speciality could have influenced her interpretation of the data. The researcher ensured that this background was considered throughout the research process. Because of resource limitations, it was not possible for transcripts to be returned to the participants for validation or to undertake member checking on the derived themes, processes that would have strengthened our study further.

## 2.8 | Ethical considerations

The study was approved by the Ethical Committee of the Ministry of Health (MoH) Kuwait (Ethics approval number: 2018/948). In addition, formal permission to undertake the study in the ICU concerned was sought (Ref:356). Furthermore, all information given by the participants was held in the strictest confidence, and only the researchers had access to it. Codes were used to identify participants instead of their names. All participants' hard-copy forms will be kept in a lock-protected cupboard at the primary author's office for 7 years from the end of the study.

## 2.9 | Data analysis

Data analysis was guided by Braun and Clarke's<sup>15</sup> approach. We followed the general strategies, which include (a) preparing and organizing the data, (b) reducing the data into themes through a coding process and condensing codes, and (c) presenting data in a discussion by each source of data collection<sup>16</sup> (p.180). The analysis process started with a close reading of the raw text to enable familiarization and understanding of the content. Notes of thoughts and memos were recorded throughout the analysis process. The initial stage of analysis used an inductive thematic analysis approach, where codes were generated from the data. A qualitative computer analysis programme (MAXQDA) software for data management was used. Team meetings were held regularly by the researchers to discuss the analytical process and refine key themes until consensus was reached. Initial coding of each transcript was made separately, and all codes were labelled and provided with descriptions. This was followed by the identification of themes for each particular dataset. The interviews stopped when no dissimilar codes emerged, when refinements were not adding any new codes, and when the study's objectives had been met.<sup>17</sup>

### 3 | FINDINGS

The findings of the study suggested that the ECMO nurses are a group of ICU nurses with strong educational and clinical background, with 95% having more than 5 years' ICU experience and 79% having more than 8 years' experience, who are specially trained to meet the complex challenging needs of ECMO patients. This relates to the training selection criteria set for ECMO nurse candidates. The main study findings are presented under three main themes: nurses' roles in ECMO, competency of ECMO nurses, and challenges of an ECMO nurse, and are supported by excerpts from the participants' interviews.

#### 3.1 | The role of nurses in ECMO

The role of nurses in ECMO was found to be diverse and challenging. Nurses reported engaging in multiple responsibilities in ECMO care. To fulfil the challenging role, nurses worked with other health care providers in a team. These issues are reported in details below.

##### 3.1.1 | Responsibilities of nurses in providing ECMO care

Study participants reported the multiple responsibilities of nurses in ECMO care. Participants acknowledged that nurses are the frontline personnel in ECMO care; hence, other colleagues relied on them for appropriate identification of eligible patients and their subsequent management. Thus, nurses emerged as a strong, reliable force for ECMO care and management.

...we are the ones who identify (any concerns with the patients) and notify the doctors. Also if any issue arises, a regular nurse will not be allowed to approach the patient alone, we have to be with them (SN-4).

Nurses at times viewed themselves as being more available to provide ECMO care compared with other staff. Some nurses expressed that their contribution to ECMO care is attributed to their care role that requires their constant presence with patients.

...nurses are staying all the time with patients (SN-15).

It was established that some of the nurses' responsibilities were based on the checklist established by Health Care Professionals (HCPs) that direct the ECMO unit in ICU, as listed in Appendix B.

##### 3.1.2 | Multidisciplinary role

Nurses reported using a multidisciplinary team approach that played an important role in the management of ECMO. Many nurses expressed that teamwork helped them to manage the various aspects

of care, such as trouble shooting and technical emergencies, ECMO retrieval, mobilizing the patients, and transferring for various diagnostic procedures. Study participants revealed that their teams were communicating through a social networking group and also had frequent meetings and discussions to deliberate on any concerns relevant to patient care.

All the members are supporting each other as a team (SN-17).

Our team is excellent. If I am in stress or busy situation, my colleague will help (SN-2).

Teamwork was seen as an important ingredient in ECMO care as other workers enhanced the nurses' role. Nurses acknowledged that, without the support of other staff, they cannot adequately attend to the critical needs of the patients.

The basic thing is how fast we can do this, otherwise the patient cannot live. Because the patient is completely dependent on ECMO. So we both together do this as a team (SN-18).

It was reported that staff of different levels and qualifications participated in ECMO care and provided unique support that enhanced the nurses' role.

Two doctors will be there in addition to perfusionist and nurses [HCPs] (SN-18).

#### 3.2 | Competency of ECMO nurses

Nurses viewed themselves as competent to perform their role in ECMO. They attributed their competency mainly to the training received and also to the experience spent providing ECMO care. Nurses expressed being "happy" about their role in ECMO as it served as a "good opportunity" of "learning new things."

I was very much interested to know about ECMO. Luckily I was selected in the first batch and I have studied so many things like machine manipulation, priming, machine set up. Day by day we are improving. (SN-20).

Nurses viewed themselves as competent to perform their role in ECMO. Nurses reported that training helped them gain confidence in managing ECMO patients. They expressed how the ECMO training received led them to proficiency in ECMO care, which enhanced their confidence in performing their role and also to lead other colleagues.

We can work as ECMO specialists in the future in advanced settings...I'm confident as I can manage patients and deal with urgent issues (SN-6).

### 3.3 | Challenges faced by ECMO nurses

Nurses reported encountering significant challenges in providing ECMO care, which interfered with their role performance.

#### 3.3.1 | Work overload

Almost all participants reported that nurses attend to more patients than what would be adequate during each shift. The scarcity of general nurses consequently affected the workload of nurses specially trained for ECMO care. Usually, ECMO nurses attended to their patients in addition to other ICU patients, which increased their workload.

Actually we have no shortage of ECMO nurses. But the ECMO nurses take care of another ICU patient because of shortage of nurses. (SN-5).

According to the nurses, a nurse patient ratio of 1:1 would be recommended in ECMO care.

It's better to have 1: 1 ratio so as to give a good quality care, for monitoring all the parameters every hour. Maximum 1: 2, 1 ECMO nurse for two ECMO patients (SN-4).

Nurses expressed their concern regarding negative effects that could arise from heavy workload. For example, some of the nurses reported failure to accomplish assigned tasks, while some experienced extreme pressure and eventual stress.

If there are three patients, it is very difficult to go and monitor them one by one and do charting for 3 ECMO patients (SN-6).

It was feared that heavy workload and its associated effects could eventually result in poor quality of patient care. To resolve the workload challenge, nurses recommended an increase of manpower, especially for general nurses to attend to ICU patients, as this would give them room to concentrate on ECMO patients.

The patient number is high and can be solved by increasing the number of staff (SN-7).

#### 3.3.2 | Inefficient communication

It was noted that communication between ECMO nurses and other staff was not appropriate as would be required, and some considered it to be conflicted.

We [nurses] are under stress, for a simple mistake [a name of HCP] is shouting and this is really harmful, even though I'm doing my work (SN-11).

Nurses viewed themselves as being disrespected when communicated to harshly by some colleagues, which they considered a negative influence on their work relationships and output.

Initially we were getting too much scolding but now we were also familiar with the insertion. Insertion time is the most stressful time for the doctors also. Some will cope with the stress and some others do not... (SN-9).

#### 3.3.3 | Lack of a structured system

To overcome some of the challenges ECMO nurses face, a structured system would be required. Nurses commented that if duties are more organized with adequate staff, there is adequate supplies for ECMO retrieval, and if there is a proper system for executing the treatment modalities, the stress and strain they undergo would be reduced. Currently, nurses reported that duty is not well organized, which affects their operations.

They [HCPs] have evening duty so they can do mobilization for ECMO patients during evening time. Mostly they are doing this in the rounds time while we [nurses] are busy (SN-1).

Nurses also reported other structural challenges such as the fear of infection from attending to sick and sometimes infectious patients and attending to heavy patients, which resulted in body strain. They reported that they regularly cared for very obese patients and came in contact with infectious cases.

Most of the ECMO patients are highly infected. So we are exposed to those infections very frequently... (SN-19).

Nurses identified some factors that can contribute to better operations in ECMO care. These included: seeing their clients recover, being appreciated, extra pay, and/or more time off duty.

Also if we are coming very late after ECMO retrieval, either somebody should say that 'ok, you did well' or should give some compensation. Nothing like money, at least they can give an extra duty off. (SN-9).

## 4 | DISCUSSION

The present study aimed to establish how nurses working in ECMO care perceived and experienced their role. The nursing role in ECMO management has been described as one of the most fundamental. Nurses form part of the ECMO care team and contribute uniquely to the various care needs of patients on ECMO. For example, ECMO

specialist nurses manage a range of complex activities, including patient-circuit interaction; the clinical needs of the patient; and ensuring the safety of the ECMO circuit through continuous surveillance, assessment, and troubleshooting, as well as preventing and managing circuit emergencies.<sup>10</sup> In the current study, nurses recognized the importance of having adequate preparedness and commitment to undertake ECMO care, owing to its sensitivity and inherent risks of the procedure.<sup>18</sup> Hence, the nurses undertook their work with caution and attention, although this impacted their time schedules and general well-being. For example, nurses reported working for longer hours than would be normally accepted.

As a complex procedure, ECMO requires a team of providers.<sup>2,7</sup> Multidisciplinary and teamwork is essential in ECMO management as various specialties bring their skills and expertise to contribute to the overall care of patients. In the current study, it was reported that teamwork played a key role in enabling nurses to provide ECMO care and to realize favourable outcomes. Without teamwork, nurses found themselves stranded and incapable of providing the required care. It is therefore essential that hospital managers ensure that teamwork is assured across the continuum of care of patients on ECMO. This not only leads to favourable outcomes for the patients but is also essential to provide relief to the nurses<sup>14</sup> by easing some of their care roles. As reported in the current study, nurses consider being supported when other colleagues are present, and this contributes positively to their personal well-being and, consequently, their productivity.

To maintain high-quality care, it is essential that a minimum of two carers attend to one patient on ECMO. This approach has been adopted by health care providers in Kuwait, following a recommendation by the Ministry of Health (Kuwait) ECMO committee Policy No (4). This is useful as the procedure is complex, and patients on the intervention tend to be critically ill, necessitating dependence on others for most of their needs, including activities of daily living, such as mobility.<sup>10</sup>

The competence of staff is a critical ingredient of successful ECMO management. To gain the required competence, nurses in the current study applauded the comprehensive training received, which is mainly specialty training in ECMO management. It has been observed that undertaking specialized training in ECMO care improves nurses' competence and confidence in managing ECMO patients by attending to life-threatening problems and mitigating likely complications during the ECMO procedure.<sup>3,19</sup> In clinical settings where ECMO patients are primarily managed by the ICU nurses, it is essential that they are specifically trained in ECMO patient and circuit management (ELSO Guidelines for ECMO Centers, 2014). In addition, continued professional development is recommended to keep nurses aware and updated regarding new developments in ECMO management.<sup>3,13,20</sup> Further still, nurses who had worked in ECMO management for a reasonable period of time reported increased confidence and job satisfaction over time, a finding that is supported in the literature,<sup>8,13,14</sup> suggesting the need to minimize staff turnover in ECMO care units.

Experiences of working in ECMO reveal several challenges that health care professionals face, and these have been largely associated with the demanding nature of the intervention. Inadequate staffing,

translating into work overload and consequently burnout, was reported in the current study. Nurses reported working on an average of 1:3 nurse to patient ratio as opposed to the recommended average of 1:1 nurse to patient ratio.<sup>1,21</sup> Other challenges reported included providing mobility care, which often resulted in physical exhaustion and emotional distress. In other instances, nurses were concerned about fears of contracting infectious diseases. Indeed, there have been reports of nurses being infected at their care stations with infectious diseases such as H<sub>1</sub>N<sub>1</sub><sup>14</sup> and the recently erupted coronavirus.<sup>22-24</sup> Considering the adoption of ECMO in the management of COVID-19 and other highly infectious conditions, it is critical for nurses working in ECMO care to receive adequate protection from hospital-acquired infections.

Working in an ECMO environment indeed requires nurses to be in the right health and emotional well-being. Nurses in the current study generally gained their strength from within and also by recognizing their impact on the recovery of patients. It is recommended that nurses be provided with a favourable and supportive environment to facilitate their care role. Honey and Wang<sup>14</sup> recognize the need for acknowledging and rewarding the highly specialized ECMO nurses who provide frontline care and who potentially put themselves at risk of infection.

## 5 | LIMITATIONS

We recognize that it is important to have perspectives of nurses from various contexts and settings to broaden our understanding of the role of ECMO care and support the conclusions made. Hence, being a single-institution study, our findings may not be applicable beyond the context of the study. This limitation calls for the need to undertake similar studies in other ECMO centres across Kuwait and other nations to generate more representative conclusions that could inform improvements in ECMO management. In addition, this being a relatively new area in clinical care, there are little published data for support or comparison of our findings. Being an emerging intervention, and given its application in the management of COVID-19 patients, we highly recommend further research internationally in this area. Furthermore, our study used a purely qualitative approach. While we recognize that qualitative studies can in themselves be pragmatic, they demonstrate a limitation of self-reporting bias. Hence, the recommendations generated from this study should be used in consideration of other related studies.

## 6 | CONCLUSION

Understanding of the complexity of ECMO care and the interactions within the care setting is essential for the transformation of nursing practice. This study suggests that nurses play an integral role in the management of patients on ECMO. An understanding of their role and their competence, the challenges they face within the care setting, and providing them with a supportive environment is essential

for transforming the practice of ECMO nursing. Positive outcomes of ECMO care necessitate close collaboration between health team members, adequate staffing, ongoing learning activities, recognition, and motivation. Adequate protection of nurses from infections while providing care for patients with infectious diseases is essential. Further research should be undertaken in the area of ECMO nursing from diverse contexts to generate evidence to improve patient care.

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## SUPPORTING INFORMATION

Additional supporting information may be found online in the Supporting Information section at the end of this article.

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